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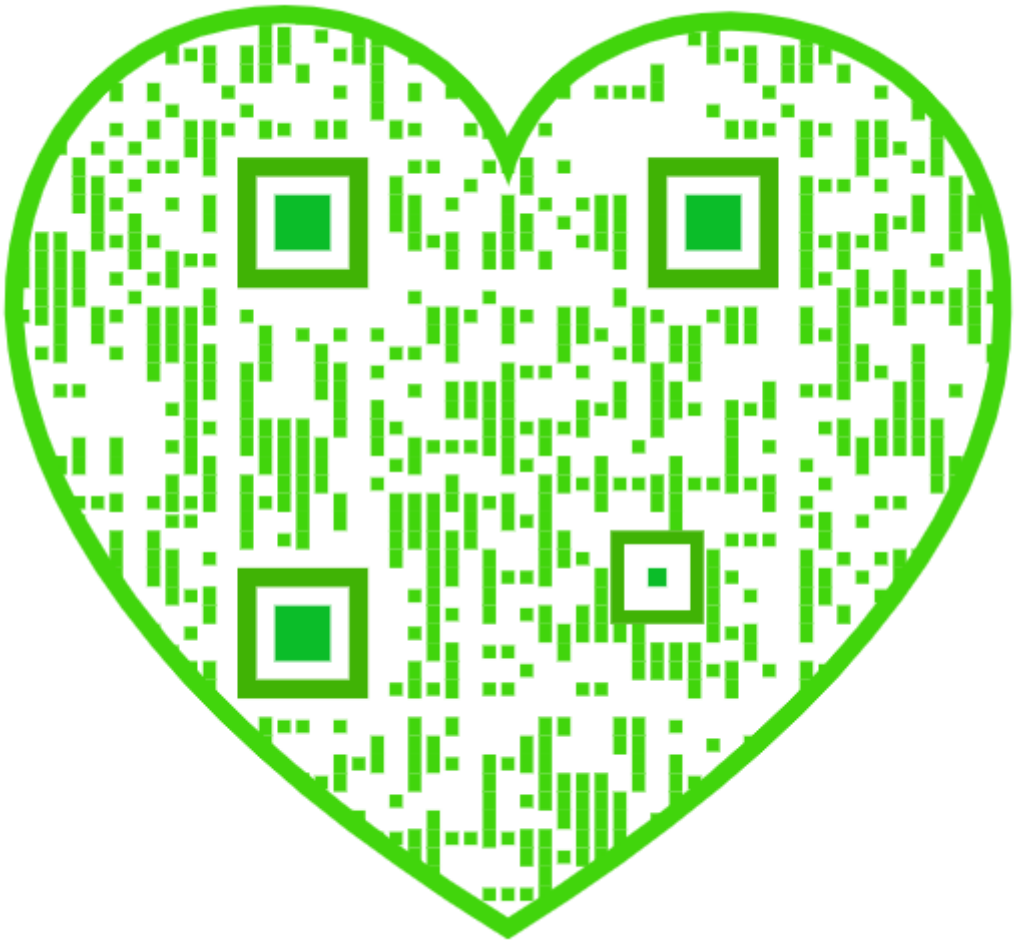
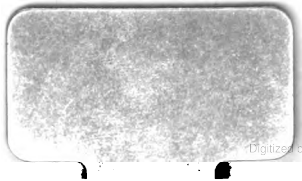


Who was the first architect? or, Bees and bee-hives

Who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WHO WAS THE FIRST ARCHITECT?

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THE COTTAGER'S TREASURE

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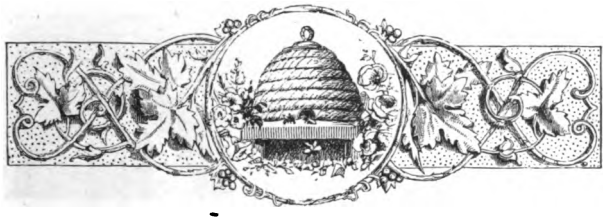


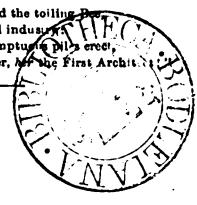
WHO WAS

THE FIRST ARCHITECT?

OR,

BEES AND BEE-HIVES.

"For ages Man has praised the toiling Bee,
As primal type of skilful industry;
We boastful may our sumptuous piles erect,
But learned we not of her, Nor the First Architect."



LONDON:
T. NELSON AND SONS, PATERNOSTER ROW;
EDINBURGH; AND NEW YORK.

1874.

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WHO WAS THE FIRST ARCHITECT?

CHAPTER I.

INTRODUCTORY.

MR. WALTERS and his son were sitting in their garden one fair summer afternoon with the leafy shelter of a fine tree above them, and the landscape of a joyous country round them, when Charlie, who had long been contemplating the noble, stately tower of the village church on the neighbouring hill, suddenly exclaimed, "What great architects there must have been in the old days, papa!"

"Yes, indeed, men who built out of a genuine love of their art, and a spirit of devotion, putting their best powers into all their work, and allowing of nothing mean, shabby, or superficial."

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"Do we know the names of any of the great architects?"

"Do you mean of Greece and Rome?"

"Yes, papa."

"Only of a very few; but we know them by their handiwork. We know there were famous men in the days of old, from the famous monuments they have left behind them."

"Oh, tell me, papa, the names of some of these famous monuments!"

"What! do you expect me, as I lie here, on the greensward, this beautiful noon, enjoying the fragrance of the flowers, and the insect murmur in the air, to recall to my memory the great edifices of ancient Greece and Italy,—to say nothing of the immense structures raised by Medians, Chaldeans, Assyrians, and Egyptians?"

"No, papa, but just tell me a few."

"I should think that you yourself could tell me the names of many. Do you not remember the sublime Capitol of Rome, elevated on one of its highest hills, and serving both as a palace and a fortress? Do you not remember the rich pillars and lofty roof of the Temple of Jupiter Capitolinus? Shall I recall the Ionic portico of the Temple of Saturn; the beautiful Arch of Septimius

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Severus; or the still more beautiful arch which commemorated the victories of Vespasian and Titus? Above all, do you not recollect the Coliseum—that gigantic amphitheatre which, if stones could speak, would strike horror to your heart with its tales of bloodshed and human suffering? Then, there was the Pantheon, the Temple of all the Gods, which a great poet has thus described:—

'Simple, erect, severe, austere, sublime,—
Shrine of all saints, and temple of all Gods,—
From Jove to Jesus—spared and blest by Time;
Looking tranquillity, while falls or nods
Arch, empire, each thing round thee, and man plods
His way through thorns to ashes—glorious dome!
Shalt thou not last? Time's scythe and tyrants' rods
Shiver upon thee—sanctuary and home
Of Art and Piety—Pantheon! pride of Rome!'"

"Bravo, papa! What a good memory you must have!" exclaimed Charlie. "And now tell me of Greece and its wonders."

"Most of the finest buildings of Greece were centred in Athens; Athens, one of those cities which human history and human genius seem to have made immortal; which, in spite of political decay, in spite of the ravages of fire and sword, in spite of the ignorant fury and greed of plunder of barbarian conquerors, must always make a lasting impression on the imagination of men. As it

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has been very well said, a thousand years unfold about it their wondrous glories; art, science, literature, the heroic deeds and heroic thoughts of heroic spirits, clothe it with associations of undying interest; and the pilgrim paces its way-worn streets with an emotion of awe and tenderness, as if he walked in the very presence of the Immortals. But I am talking, as people say, above your head, Charlie."

"Oh no, papa; I understand you thoroughly!"

"Well, I will just name some of the finest edifices of Athens. The great Acropolis, for instance, which was wholly composed of marble; the Temple of Victory; the Erechtheum and the Pandroscion, as they were called; and the grand Temple of Minerva, or the Parthenon. But I may speak of the Temple of Jupiter Olympius, upwards of 350 feet long, by 150 broad; of the Temple of Theseus, supposed to have been erected a few years after the victory at Marathon; and of that elegant octagonal or eight-sided monument, long erroneously known as the 'Lantern of Demosthenes.'"

"They must have been great men who constructed these magnificent structures!"

"Not greater, I think, than those to whose

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THE BEE-HIVE IN THE GARDEN.

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genius we owe the cathedrals, abbeys, palaces, bridges, and the like, of modern Europe."

"I suppose we don't know the name of the first architect," inquired Charlie.

"No, indeed. I suppose the designer of the Tower of Babel was one of the earliest members of the 'profession,' but, assuredly, his name is not recorded. Yet I forget: the first of all architects was an insect, and we do know *its* name."

"Nonsense, papa! an insect an architect! I should like to see a specimen of his architecture!"

"Well, so you can. There are, at least, four specimens—and four excellent specimens—in our own garden."

"I have looked all round," said Charlie, "and can see none; I am confident, papa, you are playing off one of your jokes upon me."

"No, indeed. I maintain that the first architect was the Bee; and that a bee-hive is, in its way, as fine a specimen of architecture as the Parthenon at Athens, or Pantheon at Rome."

"A bee!" cried Charlie; "who would ever have thought of a bee as an architect? I never knew he—"

"You should say, she."

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"Well, she, then—did aught but yield honey, which she stored up in a lot of cells."

"True; and I am prepared to prove to you that these cells are built and arranged on the true principles of architecture, and that the bee is fully entitled to all respect and consideration as an architect."

"If you will *prove* your statements, papa, I will listen gladly; and I will afterwards treat the bee with much more esteem and admiration."

GATHERING POLLEN.

"You will find, then, from what I shall tell you, that we may learn many very valuable lessons if we deign to study the habits and manners even of insects. In God's work, believe me, there is nothing useless, nothing profitless, nothing which does not tend to the edification of man. We say,

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'Only a beetle; only an ant; only a gnat;' giving no heed to the marvellous organization of these apparently insignificant insects. Why, the greatest painter that ever lived never matched the brilliant wings and shade of the beetle; the greatest inventor whose name is recorded in the annals of science never produced such a wonder of mechanism as the flying apparatus of the gnat. The truth is, we have copied many things from the insects; they have directed us in the way we should go."

"Yes, we have learned from the wasps to make paper."

"And the silkworm has taught us to manufacture silk. In fact, as a trustworthy writer says, it can never be too strongly impressed upon a mind anxious for the acquisition of knowledge, that the commonest things by which we are surrounded deserve the most minute and careful attention. It is in these commonest things that God is most clearly seen. When we stand astonished before the glories of the aurora borealis, or gaze in wonder at the lofty peak of a snow-crowned mountain, it is well to remember that though they vividly illustrate the grandeur of God, they do not so clearly show his infinite

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wisdom, his adaptation of means to ends, his extraordinary foresight, his boundless love, as the insect that lives its little life on a blade of grass!

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CHAPTER II.

DIFFERENT KINDS OF BEES.

"They have a king, and officers of sorts;
Where some, like magistrates, correct at home;
Others, like merchants, venture trade abroad;
Others, like soldiers, armèd in their stings,
Make boot upon the summer's velvet buds;
Which pillage they, with merry march, bring home
To the tent-royal of their emperor;
Who, busied in his majesty, surveys
The singing masons building roofs of gold;
The civil citizens kneading up the honey;
The poor mechanic porters crowding in
Their heavy burdens at his narrow gate;
The sad-eyed justice, with his surly brow,
Delivering o'er to executors pale
The lazy yawning drone."—SHAKSPEARE.

"BEFORE I begin to speak about the architecture," said Mr. Walters, "I must first describe the architect."

"All the animal world, as I suppose you have learned, is divided into families or orders, named after certain peculiarities which belong to all the members of any one order

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or family. Now, there is an order called *Hymenoptera*—an order of insects—whose wings, as the name indicates, are made of membrane; and to this order belong the Bees. And then, as the female bees are mostly furnished with a sting, they are included in a sub-section of this order—*Aculeata*, armed with a lance. Formerly, bees were comprehended in the genus *Apis*—"

"Latin for bee, papa."

"Quite right;—in the genus *Apis*, but now they are divided into many genera, while the names *Anthophila*, or 'flower-loving,' and *Mellifera*, or 'honey-bearing,' are given to the numerous family which they constitute. No fewer than two hundred and fifty species of bees are found in various parts of Great Britain; and all these, when in a perfect state, feed chiefly or altogether on saccharine juices, such as the 'honied stores' of flowers; while the young, or larvæ, are fed with the pollen, or dust, of flowers; and a paste, called bee-bread, composed of pollen and honey."

"Well, I have heard of many varieties of bread—wheaten, barley, rye, rice, and fancy-bread—but bee-bread, I don't believe any confectioner or baker sells it!"

"He does not know the receipt, Charlie! Now,

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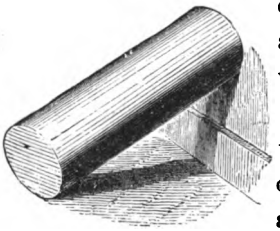
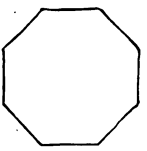
confining myself to the common, or, as it is generally styled, the Hive-Bee,* whose ways and habits have been carefully studied by Huber and other illustrious naturalists, it appears that each community of bees consists of from 10,000 to 60,000 members: of these one is a perfect female, and the mother or queen bee; from 600 to 2000, at certain seasons, are males; and the remainder are workers, or neuters.



CYLINDER.

"The entire period of the life and reign of the queen is calculated at about two or three years. During this period, it cannot be said that she performs any good work for the welfare of her realm, other than increasing its population. When she issues from the egg she is, like the rest of her sisterhood, a helpless and an ugly grub; yet you can plainly tell that she is destined for a favoured life, from the fact that her birth-chamber is of larger dimensions, is vertical in position, and is shaped more like a cylinder than an octagon. She



OCTAGON.

* *Apis mellificatus.*

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is thus provided with sufficient room for the due growth and expansion of all her members, as she advances towards maturity; and to hasten this growth and expansion, her nurses and future subjects supply her with an abundance of the richest and most nourishing food; not the simple bee-bread, of which I have already spoken, and which is considered sufficient for common bee-infancy, but a rare and rich preparation compounded from flowery juices, and called 'royal jelly,' because reserved expressly for royal nutriment. Thus spaciously lodged and delicately fed, the favoured grub, when arrived at full growth, spins within her cell a silken shroud; therein changes to what is called a nymph or pupa; and thence, in due time, issues forth in all her dignity of majestic size, in all the resplendency of her golden-ringed body-suit, the more conspicuous for the scantiness of her gauze drapery,—those filmy wings in which alone her outward gifts, instead of surpassing, are inferior to, those of her subjects."

"It seems," said Charlie, reflectively, "a fine thing to be a queen."

"Well, now let us turn to the bee-worker, who, on emerging from her egg, finds herself inhabiting one of the hexagonal or six-sided cells, of

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which the hive is in the main composed. The shape and proportion of the cell, as well as the quality of her bee-bread, seem purposely calculated to diminish her growth; but they in no wise deteriorate her working faculties."

"What about the males, papa? Have you nothing to say in *their* favour?"

"These are the *drones;* and I can't say much in their favour, because they never do much to

THE BEE.

deserve it. Their existence is a very joyous one between April and August, during which time they participate in, or contend for, the royal graces, and are supported at the cost of the bee-workers; but when the queen has finally chosen her partner or partners from them, the bee-workers fall upon the rest, and sweep them away in one general massacre.

"Such are the three orders, or degrees, which exist in the great bee community."

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"Yes: the queen, the workers, the drones. But you have told me nothing about their stature or appearance. How shall I know one from the other?"

"Well, listen: the worker is about half an inch long, and about one-sixth of an inch broad, at the upper part of the abdomen. The antennæ, or feelers, are twelve-jointed, and each terminates with a kind of knob. The abdomen consists of six joints, or rings; and under the scaly coverings of the four middle ones are situated the *wax-pockets*."

"Wax-pockets," exclaimed Charlie.

"So they are called; because they are the organs in which the secretion of wax takes place. At the extremity of the abdomen is situated the *sting*, which is straight. The lower joint of the hind tarsi, or ankle, if I may so call it, is widened until it forms a basket, fit for the reception of the pollen collected from the flowers by the hairs which thickly cover the little creature's legs."

"And what about the drones?"

"These are the male bees, and, unlike the males in most communities, do no work at all. They are called *drones*, from the peculiar noise they make in their flight; are much larger

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than the neuters or workers, and thicker in proportion. The antennæ, or feelers, are provided with an additional joint. The eyes are remarkably large, and meet upon the crown. *Observe:* neither males nor queens have wax-pockets, nor pollen-baskets; their legs are less hairy; and the queen bee's sting is not straight, but curved.

A DRONE-BEE.

"Of the perfect females it may be said that they are much larger than either the workers or the males; they are also easily known by the yellow tint of the under part of the body, and by the extreme shortness of their wings, which, instead of extending to the extremity of the abdomen, leave some of its rings uncovered.

LEG AND TARSUS OF DRONE BEE.

"Such being the different inhabitants of a beehive, I shall now proceed to give you a sketch of their characteristic habits, and then of the building, outside and inside, which they construct with so much architectural skill."

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CHAPTER III.

GENERAL SKETCH OF THE HABITS OF BEES.

"Many-coloured, sunshine-loving, spring-betokening bee!
Yellow bee, so mad for love of early-blooming flowers!
Till thy waxen cells be full, fair fall thy work and thee,
Buzzing round the sweetly-smelling garden-plots and flowers."

"THE life of the mother or queen bee," said Mr. Walters, "is mainly occupied in laying eggs to increase the population of the hive. This increase, though varying according to the state of the weather, is, on the whole, very rapid—sometimes at the rate of 300 eggs in a day, or in the later spring months of 1000, or even 2000. The increase, however, is not continuous. Under certain conditions, which I shall duly describe to you, a grand emigration, or, as it is called, *swarming*, takes place, and new bee-colonies are established.

"Respecting the males, I must add to what I

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have said before, that their only known use is to assist the queen in peopling the hive; and after the swarming season is over, the great majority of them are slain in cold blood by the workers, as if the latter were afraid they might consume too much of their winter store.

"The greater part of the workers themselves do not live out a twelvemonth; but the queen bee's existence often stretches beyond a period of three years.

"Now, Charlie, we will suppose that you and I are wandering, one bright warm night in May, in the vicinity of a bee-hive. To our surprise, instead of the stillness which generally prevails at night, there is a loud commotion; sounds fall upon our ears as if the interior of the hive were the scene of a sudden tumult. And these sounds continue throughout the night, and throughout the next morning, and even into mid-day. They are indicative of a swarming or emigration, and lo, about noon, forth rush the body of emigrants, either preceded or followed by their queen. Leaving them settled for a while on a neighbouring bough, you and I return to the original hive. Here tier upon tier of six-sided cells hang suspended from the roof, most of them occupied

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as the sleeping-nests of the industrious workers, the nurseries of the infant bees, and as store-houses for honey and bee-bread. But no one is asleep. The departure of the queen bee has left the little state without a head; and like the House of Commons without a Speaker, the continuity of its business has been interrupted. To gather up the broken reins, the remnant left in the hive proceed, like the House of Commons, to choose a new ruler."

"Oh, go on, papa!" exclaimed Charlie; "this is better than a fairy tale."

"I should think so, for truth is stranger than fiction. Well, among the mass of six-sided cells which chiefly compose the hive, you would perceive, on a glance into the interior, some half-dozen oval chambers, each thrice the size of a common cell, and these are—what?"

"Of course, the royal nurseries."

"Yes; and within these 'waxen palaces' have been for some weeks carefully fostered, in different stages of growth and development, some half-dozen princely infants, for one of whom the royal crown of Bee-land is intended."

"But for which one?" inquired Charlie. "How do the bees determine?"

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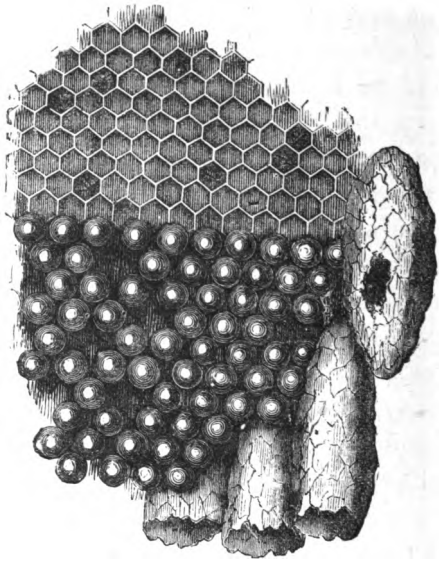
"We shall see. After waiting a while, with a patience never exhibited by human subjects, the bees are gratified by the emergence of a royal lady, full-grown, ripe, and mature, from one of



PORTION OF HIVE, SHOWING THE ROYAL AND ORDINARY CELLS.

the royal chambers. It is a case of 'first come, first served.' The bees salute her with a loud hum of applause and congratulation. The queen is ready to assume her royal state; but there is many a slip 'twixt the cup and the lip. Behold!

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another would-be queen issues from another royal chamber, and catching a glimpse of her rival, flies straight against her in a fury of royal rage.

"What poet could fitly sing the combat that now ensues? Head to head, chest to chest, they grapple and they struggle, and each has only, dragon-wise, to curve her tail and fix her venomed dart, and both, like the celebrated Kilkenny cats, will then fall victims to the mutual stings.

"But lo! at this critical moment, as if stricken simultaneously with panic fear, they part, and recede from the deadly and too equal combat.

"Hitherto the spectators have been looking on inactive, but not mute, for they have maintained a ceaseless hum; but now that the royal warriors seem abashed, the hum swells into a tremendous roar. A few individuals, darting from the crowd, dare to seize upon the retreating queens and stay their flight, who, aroused by this indignity to a fresh access of rage, burst from their subjects' hold, and renew the fierce encounter. The issue does not long remain in suspense; for now one of the queenly warriors, stronger or more skilful than her sister, rises above her, seizes a scanty wing, and inflicts a mortal sting on her unpro-

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tected body. Then she quickly withdraws her fatal weapon, while the hapless rival, after a brief death-agony, expires."

"And is all this true?" said Charlie, fixing on his father a gaze of wonder and admiration.

"Actually and positively true. And what think you is the next task of the victor? She approaches the royal chambers where still repose, unconscious, the four remaining nymphs or larvæ of regal lineage. She tears aside from the entrance of each the silken hangings which partially protect it, thrusts through the aperture her poisoned dart, and, one by one, slays each probable rival. In this cruel work her subjects are pleased participants; for no sooner does she abandon the scene of each successive assassination, than they drag from it the corpse she has left behind, and hasten to conceal the evidence of her fatal jealousy.

"We are told that it seems essential to the well-being of a hive that only one sovereign should be acknowledged, on the principle of Alexander the Great, that two suns cannot shine in one hemisphere. On this single sovereign, as the universal mother, the parent and populator of all the hive, depends not only the prosperity, but

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the very existence of the state. Moreover, without a queen to guide or accompany the swarm, no emigration could take place. Hence, to guard against risk of accident, it is necessary to keep up a surplus supply of royal nymphs. But it will sometimes happen that, notwithstanding all their care and forethought, a hive finds itself bereft of its sovereign, and without any successor to take her place."

"What is to be done then, papa? Do they elect one of themselves?"

"No; one of the most extraordinary of natural phenomena then takes place. Having lost their sovereign, the bees set to work to *make* another."

"What! to *make*, to *manufacture* another? Oh, surely you are joking!"

"Nay; I speak but the plain unvarnished truth. After devoting some few hours to decorous lamentation, they suddenly address themselves to the task of destroying—I mean, *apparently* destroying — their beautiful little city. Several parties here and there attack the six-sided houses, hastily toppling down their waxen walls, without any regard to the young which lie slumbering in happy ignorance. Of these unhappy little ones, perhaps four or five in number,

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the destroyers sacrifice all but a single nymph; and then, indeed, they lavish on this chosen object an amount of affection which almost compensates for the cruel slaughter of their kin. By pulling down the cells on either side, they convert the little nursery into a spacious palace-chamber, which allows its occupant unlimited space for growing; and there she lies for about ten days, being assiduously crammed meanwhile with 'royal jelly.'"

"Well," said Charlie, "I call that a new way of making a queen. But go on, papa. I hope you are not tired, for I am not."

"I think the next point to be discussed is this, Whence do the bees obtain the materials for their wax and honey? Look at these little creatures now softly humming round us, and flying from flower to flower with what appears to be an indefatigable curiosity. They are at work, we know, but they wisely make a pleasure of their work, and each little adventurer roams about in the

BEES.

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sunshine with a sense, I think, of positive enjoyment.

"'Hot midsummer's petty crone,
Sweet to me thy drowsy tone,
Telling of countless sunny hours,
Long days and solid banks of flowers;
Of gulfs of sweetness without bound,
In Indian wildernesses found;
Of Syrian peace, immortal leisure,
Firmest cheer, and bird-like pleasure.
Wiser far than human seer,
Yellow-breeched philosopher!
Seeing only what is fair,
Sipping only what is sweet,
Thou dost mock at fate and care,
Leave the chaff and take the wheat.'

"You will remember that I have described the bee's thigh as loaded with a kind of pannier or basket, into which, when she meets with a suitable flower, she brushes off the *pollen* or dust; and having sucked in a full store of 'nectared sweets,' she makes her way, as straightly and as swiftly as an arrow, to her busy home.

LEG OF A BEE.

"Having arrived at the gate, and been examined by the sentinels, she passes into the interior, and immediately presents to the queen, as an act of homage, a portion of her honey. She

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then puts aside a little for her own use, and the remainder she deposits within one of the store-cells set apart for this purpose. Her next step is to get rid of the contents of her pollen-basket. This flower-dust, or flower-farina, after undergoing a certain process, of which swallowing forms a part, becomes the 'bee-bread' of which we have already spoken, and the most valuable nutriment of 'bee-existence,' especially before the stage of maturity is reached. After being swallowed, it is probably administered at once, like 'golden syrup,' to some of the baby occupants of the nursery cells; or, if more has been collected than immediate need requires, this, like the honey, is first diluted and packed, and then laid up for future use.

"We have seen, to use the language of an agreeable writer, how our most industrious gatherer has brought home her share of pollen, or 'bee-bread,' and honey, or 'bee-wine;' but where is her portion of *wax*—of that all-precious material in which both the bee-bread and the bee-wine are so carefully preserved?

"On this occasion, having given away all her honey, she can make no wax;—a lesson that we should be just before we are generous.

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"Long ago not one of the observers of bees, or keepers of bees, could have told you why a bee without honey could not contribute wax, though the answer to the question could now be given by almost any school-boy."

"Not by me, papa."

"That is your own fault, for not having read more, or kept your eyes open. The opinion formerly held was, that humble-bees, and all bees, either collected their wax ready-made from the flowers, or manufactured it from the pollen which they stored up in their thigh-basket. That there was a mistake here—that the chief foundation of wax could not be pollen, because of the varied colour of the latter—was first observed by the great anatomist, John Hunter. Huber and others, starting from this observation, and making numerous experiments, found that bees which were fed *entirely* upon honey and sugar, and deprived, at the same time, of all opportunities of collecting pollen, succeeded nevertheless in constructing their honeycombs and wax; though without the 'bee-bread' made from the flower-farina, or pollen, they were wholly unable to feed their young.

"Hence this result follows: that honey, or

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sugar, and *not* pollen, is essential to the manufacture of wax—a secretion which, exuding from the rings of the bee's stomach, is sometimes visible in the form of scale.

"But besides the pollen and the wax, the vegetable world furnishes the bees with yet another material for their architectural works. This substance is called *propolis*, from two Greek words signifying 'before the city,' and is so called because it is chiefly applied externally, and to the outworks of the waxen edifices. It consists of a brown resin, collected from trees producing a certain kind of gum. The bees in collecting it make free use of their thigh-baskets; but to avoid their movements being impeded by so adhesive a substance, they knead it up, and render it more tenacious, before transferring it to their receptacles.

"With this propolis all accidental holes and crevices are filled up, and the honeycombs, originally of the purest white, are carefully varnished.

'Now, is not all this very wonderful, my boy? How is the bee taught to collect this pollen, and this honey, and this propolis; and how does it acquire a knowledge of the purposes to which

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each should be devoted? Let me quote you some fine melodious and sensible lines of Prior. He exclaims :—

"Tell me, ye studious, who pretend to see
Far into Nature's bosom, whence the bee
Was first informed her vent'rous flight to steer
Through trackless paths and an abyss of air?
Whence she avoids the slimy marsh, and knows
The fertile hills where sweeter herbage grows,
And honey-making flowers their opening buds disclose?
How from the thickened mist and setting sun
Finds she the labour of her day is done?
Who taught her against winds and rains to strive,
To bring her burden to the certain hive?'

"There can be but one answer, Charlie, whatever the presumptuous ingenuity of man may endeavour to devise. The knowledge, instinct, intelligence—whatever you choose to call it—of the bees, as of other insects, must have had a divine origin, must have sprung from God."

"How wonderful are all thy works, O God!" exclaimed Charlie, in a reverent voice, and with folded hands.

Mr. Walters rested a while, and then resumed.

"During cold weather bees appear to lapse into a semi-torpid condition, and consume much less food than at other times. Their respiration is conducted by means of *tracheæ*, or air-tubes, and

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THE COTTAGER'S TREASURE

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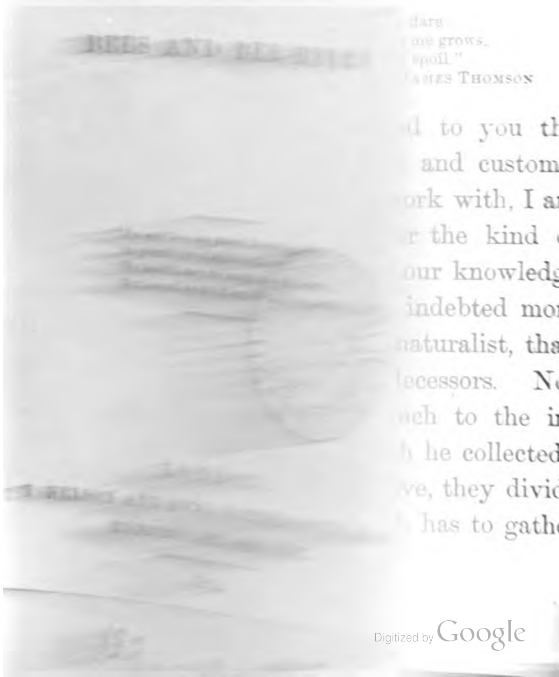

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AMES THOMSON

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its activity is greater or less according to the insect's greater or less activity.

"It may well be deemed an extraordinary fact, says a writer, that among the enemies of our skilful and industrious little architects are to be counted certain species of moths, which, despite the danger lurking in the stings of the bees, enter the hives and deposit their eggs. After these are hatched, they feed upon the combs. Mice sometimes nibble their way into the hives in winter, and destroy and pillage uncontrolled.

"Bees are not wholly of a pacific nature. Their wars are frequently of a most desperate character. When one community is attacked by others, it will offer a gallant resistance, and does not yield until overcome by numbers. The weaker hives are very much exposed, in the sweet spring-time, when flowers are few, to these destructive raids."

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CHAPTER IV.

THE BEE-HIVE.

"Here their delicious task the fervent bees
In swarming millions tend; around, athwart,
Through the soft air the busy nations fly,
Cling to the bud, and with inserted tube
Suck its pure essence, its ethereal soul;
And oft, with bolder wing, they soaring dare
The purple heath, or where the wild-thyme grows,
And yellow load them with the luscious spoil."

JAMES THOMSON.

"NOW that I have described to you the architects, their manners and customs, and the materials they work with, I am naturally led to consider the kind of edifice they erect. For our knowledge of its skilful arrangements we are indebted more to the perseverance of Huber, the naturalist, than to all the observations of his predecessors. Nor have succeeding students added much to the interesting and valuable details which he collected.

"When bees begin to build a hive, they divide themselves into bands, one of which has to gather

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and produce the materials; another works them up, and forms them into a kind of outline of the dimensions and partitions of the future cells; and a third brings provisions to the labourers, who are unable to leave their work. But, according to Mr. Rennie and other observers, no distribution of food is made to those whose task of collecting propolis and pollen calls them to the field. It is presumed they will attend to their own wants. Nor is any allowance supplied to those who initiate, as it were, the architecture of the cells. Their province is very troublesome, because they are compelled to level and extend, as well as to cut and shape the wax to the required form and dimensions; but, after awhile, they complete their task, and retire to the fields to regale themselves with food, and to refresh themselves with a sense of unrestrained liberty and pleasure. But their successors have to draw their mouth, their feet, and the extremity of their body, several times over the entire surface of their work; and as they never desist until the fatiguing occupation is at an end, they frequently require refreshments, for which purpose waiters are always in attendance with a sufficient supply. The worker, when hungry, bends down his trunk before his purveyor,

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to intimate that he fain would eat. Immediately, the other opens his bag of precious honey, and allows a few drops to trickle out. The brief repast over, back goes the labourer to his toil, and with his feet and body repeats the same motions as before.

"Now, observe, Charlie, the book I have beside me,—and which induced me at the outset to talk upon this particular subject,—is Huber's great book on Bees. Let me read to you his minute account of the various operations undertaken and carried through by our little architect in the erection of a hive.

"That he might watch these operations, he took a large glass vessel, shaped like a bell, and glued thin wooden slips to the arch at intervals, because the glass itself was too smooth for the bees to support themselves upon it.

"Into this glass bell was introduced a swarm, consisting of some thousand workers, several hundred males, and a fertile queen, who soon ascended to the top. Those first gaining the slips fixed themselves there by their fore-feet; others, scrambling up the sides, joined them, by holding their legs with their own, and they thus formed a kind of chain, fastened by the two ends

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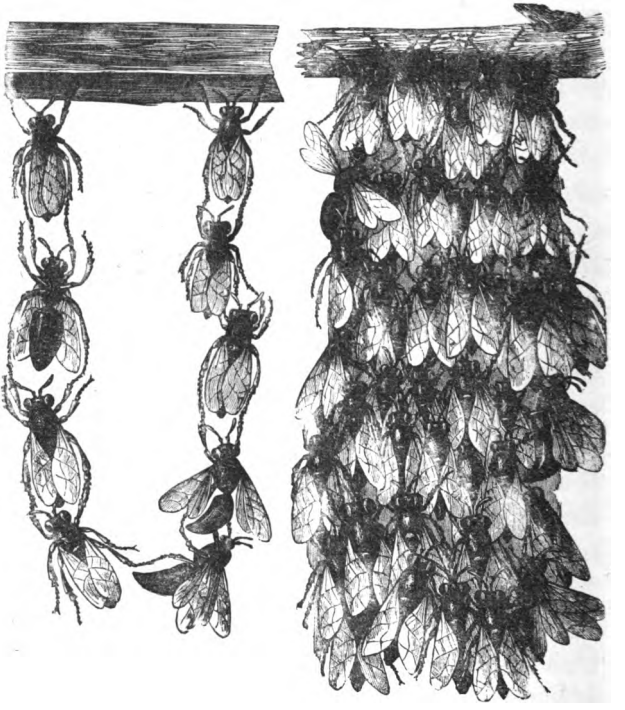
to the upper parts of the receiver, and served as ladders or a bridge to the workers enlarging their



CLUSTER OF BEES.

number. The latter were united in a cluster, hanging like an inverted pyramid from the top to the bottom of the hive.

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"The country affording but little honey, Huber provided the bees with syrup of sugar in order to quicken their work. They crowded to the edge of the vessel which contained it; and having satisfied themselves, returned to the group. A general repose now prevailed, while the nurse-bees set off into the country on a foraging expedition. Returning loaded with pollen, they kept guard at the mouth of the hive, cleansed it, and closed up its edges with propolis. For about fifteen hours the wax-workers remained motionless—the curtain of bees, consisting always of the same individuals, assured the observer that none replaced them. A few hours afterwards, it was discovered that all these individuals had wax scales under the rings; and next day this phenomenon was still more general."

"Wax scales, papa? Oh, you spoke about *them* before," said Charlie.

"The bees on the outside of the cluster now changed their places, and by so doing displayed their bellies more distinctly. Owing to the projection of the wax scales, the rings seemed edged with white. In several places the curtain of bees, as I have called it, was completely rent, and some degree of commotion was noticeable in the hive.

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"Convinced in his own mind that the combs would originate in the centre of the swarm, Huber directed his whole attention towards the roof of the glass. Just at this time a worker separated himself from one of the festoons of the cluster, and, with his head, drove away the bees at the beginning of the row in the middle of the arch, turning round and round until he had cleared a space an inch or more in diameter, in which he might move freely. Then he took up his position in the centre of the clearing.

"The worker, with the pincers at the joint of one of the third pair of his limbs, seized a scale of wax projecting from a ring, and brought it forward to his mouth with the claws of his fore-legs, when it appeared in a vertical position. Then, with his claws, he turned the wax in every necessary direction; the edge of the scale immediately broke up, and the fragments, accumulating in the hollow of the mandibles, issued forth like a very narrow ribbon, impregnated with a frothy liquid by the tongue. The tongue itself assumed the most varied shapes, and went through the most complicated operations, being sometimes flattened like a trowel, and at other times pointed like a pencil; and, after imbuing

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the whole substance of the ribbon, pushed it forward again into the mandibles, whence it was drawn out a second time, but in an opposite direction.

"At length the bee applied these particles of wax to the vault or roof of the hive, where they stuck through the saliva in them, communicating at the same time a whiteness and opacity previously wanting. I suppose, Charlie, that the object of this process was to give the wax that ductility and tenacity belonging to its perfect state. By the way, what is the meaning of those two hard words, *ductility* and *tenacity?*"

"Oh, we say a substance is *ductile* when it can be moulded into a particular shape; and *tenacious* when it keeps that state, unless some outward force be applied to it."

"Quite a learned definition! Well, the portions not yet applied the bee separated with his mandibles, and made what use of he pleased. Then he treated a second and a third scale in the same elaborate manner, and yet, the work was only planned out, as it were; for this busy worker did nothing but accumulate the waxy particles together. The bee, having thus completed his particular task, retired among his companions.

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Another, with wax under the rings, succeeded him; suspended himself to the same spot; withdrew a scale by the pincers of the hind-legs; passed it through his mandibles; carried on his fellow-worker's work—only he took care to make his deposit in a line with the former, and to unite their ends. Now came forward a third worker, who reduced some of the scales to paste, and placed them near the materials accumulated by his companions, *but not in a straight line.* Another bee, apparently sensible of the defect, removed the misplaced wax, and carrying it to the former heap, deposited it there, exactly in the prescribed order and direction."

"Well, that's what I call ingenuity! These bees are far cleverer fellows than I had any idea of."

"Live and learn, Charlie. Keep your ears and eyes open, and be always on the watch to pick up knowledge. A grain per day, and you have a heap of three hundred and sixty-five grains per annum!

"The result of all the operations which I have described was the production of a rugged surface, hanging down from the arch, without any particular angle or definite shape, or any trace of

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cells. I can only sketch it out to you as a wall or ridge, running in a straight line, and without the slightest bend or curve, two-thirds of an inch in length, about two lines high, and declining towards the extremities. Sometimes, however, the wall is from an inch to an inch and a half in length, the form being always the same; but the wall is never of greater height.

"Such is the mode in which the bee-worker lays the foundation of her cell.

"We have now to ascertain, Charlie, in what way she builds it up; how she raises on this foundation a satisfactory superstructure. To arrive at this information, I must again avail myself of the patient and ingenious experiments of Huber.

"He caused a box to be made, twelve inches square and nine deep, with a movable glass lid. Combs, full of brood, honey, and pollen were then collected from another hive, and being cut into pieces twelve inches long and four deep, they were arranged upright at the bottom of the box, at the same intervals as the insects themselves usually leave between them. The upper edge of each was covered by a slip of wooden lath. Huber did not think it probable that the bees would

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attempt to found new combs on the glass roof of the box, because its smoothness prevented the swarm from adhering to it; so that, if disposed to build, they could do so over the slips resting on the combs, which left a vacant space five inches high above them. As was foreseen, the swarm with which this box was peopled established itself among the combs below. The activity of the nurse-bees was then observable. They scattered themselves about the hive, feeding the young grubs, clearing out their lodgments, and adapting it for the proprietors. It would seem that they considered the combs, which were roughly cut to fit the bottom of the box, and in some parts damaged, in great need of reparation, for they immediately commenced the work. They beat down the old wax, kneaded it between their teeth, and thus formed materials fit for binding and consolidating the combs. Huber describes himself as astonished beyond expression to see such a multitude of workers employed simultaneously in labours to which it did not appear they should have been called, at their coincidence, their zeal, and their prudence.

"But it was still more wonderful, he says, that about half the population took no share in the

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proceedings at all, but remained motionless, while the others were so industriously occupied. This motionlessness, however, was not for nothing! They lay still, gorged with the honey put within their reach; in this condition they remained for twenty-four hours, until the wax had formed under their rings, and was ready to be put in operation. To the great satisfaction of the experimentalist, a little foundation-wall soon began to rise on one of the slips prepared to receive it.

"At first this foundation was very small, but as the work required, it was gradually enlarged. Meantime, the workers excavated on one side a hollow, of about the width of a common cell, and on the opposite surface *two others* of somewhat greater elongation. The middle of the single cell corresponded exactly to the partition separating the latter; the arches of these excavations, projecting by the accumulation of wax, were converted into straight ridges; whence the cells of the first row were composed of five sides, considering the slips as one side, and those of the second row of six sides.—Hand me that stick, Charlie. Now, on the ground here, I will draw three diagrams, to explain the enlargement of the foundation-wall,

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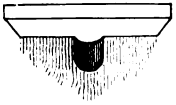
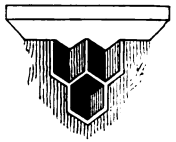
and the early operations in the erection of the cells. Do you see, Charlie?"



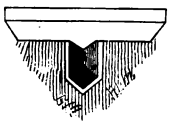
ENLARGED FOUNDATION-WALL.

"Yes, papa, and I understand."

"The structure of the interior of the cells, apparently, was derived from the position of their respective outlines. The bees possessed, most unquestionably, a remarkable delicacy of feeling, and hence they directed their teeth principally to the place where the wax was thickest; that is, to the parts where, on the opposite side, other workers had strengthened it, and, in their turn, commenced excavating.



CELLS COMMENCED.



CELLS COMMENCED.

"Thus it came about, that owing to the manner in which the excavations were opposed to each other, those of the second row, and all subsequent, partially applied to three cavities, were composed of three equal diamond-shaped lozenges. I may here remark, that each part of the labour of bees appears the natural result of what has preceded it. Therefore, as Huber distinctly asserts, chance has no share in these admirable combinations.

"But now, quitting for awhile M. Huber's ex-

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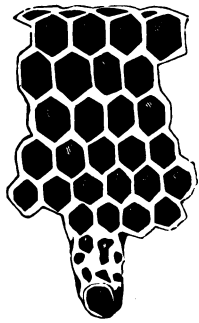
periments, I will endeavour to describe briefly the general mode of formation of the cells.



CELLS OF A BEE-HIVE.

"The combs of a bee-hive are parallel to each other, forming vertical strata of about an inch in thickness, with an interval of nearly half an inch between them. The cells, therefore, are nearly horizontal, but with a slight inclination or dip towards the centre of each comb. The workers first begin at the central comb, and then, in succession, those next to it on either side; the combs being lengthened and enlarged, when necessary, according to the order in which they were made. In each comb there are two sets of cells—that is, one on either side; and it has been put forward as an illustration of the perseverance and energy of bees, that a piece of comb, fourteen inches long by seven inches wide, and containing about four thousand cells, has been frequently constructed in four-and-twenty hours. Most of the comb consists of cells adapted for the lodgment of breeding workers; the remainder is allotted to the drones. When the principal breeding season is over, the

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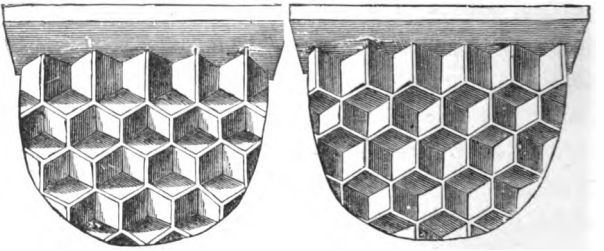
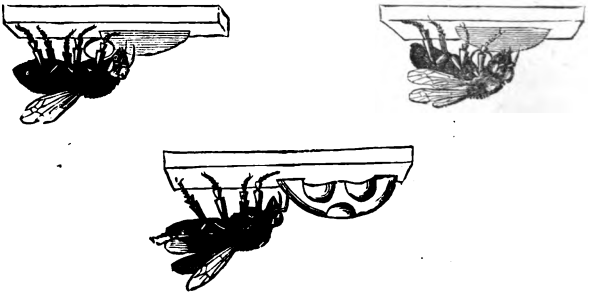
cells of some parts of the comb are often lengthened, to fit them for the reception of honey; or combs of greater thickness, with longer cells, are constructed for this special purpose; the mouth of



THE CELLS.



THE BEES AT WORK.

each store-cell, when completely filled with honey, being *sealed* or covered with wax.

"The bee's cell is a hexagon, or six-sided figure. Now, for reasons which you would hardly under-

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stand, this hexagon is a far more useful figure for a bee's cell than triangle, square, or circle. It affords the greatest strength, and necessitates the least waste of space. But the entire construction of the hive is a masterpiece of intelligence, and demands our wonder, our admiration, and, I had almost said, our awe.'

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CHAPTER V.

THE MASON-BEE.

"Would you a miracle of labour see,
Come, watch the progress of the Mason-Bee!
Ambition surely fires his little breast,
As he achieves his well-shaped, clay-built nest."

"I THINK," said Mr. Walters, "I have now gossiped long enough. Afternoon is waning into evening, and we must both stand in need of refreshment and repose. But before we go in-doors, I would like to say a few words about other bees than the hive or common bee, with which we are all so familiar, and whose ingenuity and fancy you have now begun to appreciate; and briefly trace the operations of such industrious workers as the mason-bee, the carpenter-bee, the upholsterer-bee, the humble-bee.

"A writer who is deserving of every confidence justly remarks, that it would not be easy to find a more simple and, at the same time, ingenious

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specimen of insect architecture than the nests of those species of *solitary* bees—meek, *solitary* bees, which do not live in vast communities like the common bee — which are called Mason-Bees. It was Réaumur who, amazed by the close resemblances between the proceedings of insects and some of our human industries, first applied to bees, and wasps, and caterpillars, names indicative of the character of their work. And surely, since the mason-bee builds his nest with such materials as sand, earthy substances, wood, and chalk, he may be considered to have a right to his name."

THE MASON-BEE.

"Oh yes; but instead of the First Architect, let us call him the First Mason."

"Rennie tells us, in his valuable work on 'Insect Architecture,' that on the north-east wall of Greenwich Park, at a height of four feet from the ground, he once discovered the nest of a mason-bee, formed in the layer of cement between two courses of bricks. Externally, you saw only an irregular cake of dry mud, which looked as if a handful of wet road-stuff had been removed

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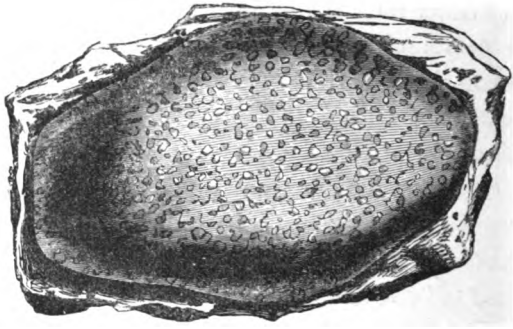
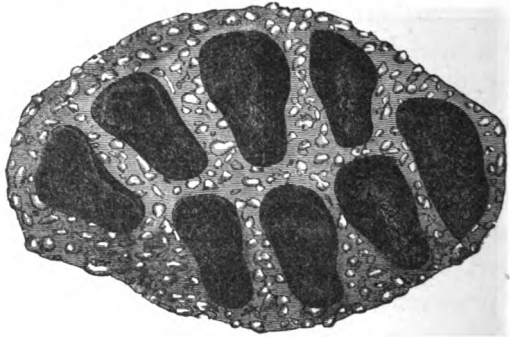
from a cart-rut, and daubed against the wall; but, on closer inspection, you found that the



NEST OF THE MASON-BEE.



SECTION OF NEST.

cake contained a larger number of stones than usually occur in the mud of cart-ruts. There was also a circular hole on one side of it which

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attracted attention, for it indicated the perforation of some insect. When examined, this hole was found to be the mouth of a cell about an inch deep, exactly of the form and size of a lady's thimble, finely polished, and of the colour of plaster-of-Paris, though stained in various places with yellow.

"This cell was empty; but when the cake of mud was cleared away, another revealed itself, separated from the former by a partition about an inch thick. Here lay a winged bee—a bee which had just emerged from the larva or nymph state, and assumed her wings. Probably the one which had tenanted the adjacent cell had already found its little pinions, and flown away rejoicing in its novel freedom of existence.

"The way in which the mason-bee builds her nest is this: she seeks a supply of suitable material—let us say, a bank of clay by the margin of a stream—and proceeds to cut out a pellet, or tiny fragment; which, after carefully kneading, and moistening with her saliva to render it more tenacious, she carries off to the spot where she has selected to build her domicile. She applies pellet upon pellet, occasionally introducing a small pebble, until she has constructed a

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kind of egg-shaped nest, within which she forms her cells.

"The very different behaviour of the bee at the clay-bank, and when building her nest, struck Mr. Rennie as not a little remarkable. When digging and preparing the clay, she showed no alarm at his approach; the work went on as regularly as if he had been at a distance; and though he was standing close to the hole, his presence did not scare away the bee on her return for fresh materials. But if he stood near the nest, or even in the road by which the bee flew to it, she turned back, or made a wide circuit immediately, as if to lure him from the neighbourhood of her little home. She would even turn back when her observer was at such a distance that it could scarcely be supposed she was jealous of him; but, mayhaps, she had detected some prowling ferocious insect, watching her flight with designs upon her provision for her future progeny.

"It is in instances such as these, says Mr. Rennie,—and this is the lesson, Charlie, I want you to learn,—instances which exhibit the adaptation of an *instinct* to *circumstances*, that our reason finds the greatest difficulty in explaining

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the governing principle of the minds of the inferior animals. The mason-bee builds her nest by an invariable rule; the model is in her mind, so to speak, as it has been in the mind of her race from their first creation: they have learned nothing by experience. But the mode in which they accomplish this task varies according to the situations in which they are placed. They appear to have a glimmering of reason, employed as a help to, and an instrument of, their instinct.

"But, as I have said before, who implants in them this instinct, or this glimmering of reason? There can be but one answer, Charlie: a divine, a supernatural, a creative Power—the Power which we love, worship, and glorify, as—GOD."

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CHAPTER VI.

THE CARPENTER-BEE.

"FROM the mason-bee I turn to the Carpenter-Bee (*Xylocopa lapensis*) a beautiful South African genus. The process by which she constructs her nest is as curious as it is ingenious; and, moreover, it is as nicely calculated as if it were regulated by exact scientific principles.

THE CARPENTER-BEE.

"The bee, having selected a suitable piece of wood, such as a branch or the trunk of an old and decayed tree, or a post which has seen many days and has lost its original strength, she bores in it a circular hole about an inch and a half in length, which is large enough to permit her to pass. Having got as far as this, she suddenly turns off at an angle, and drives her tunnel

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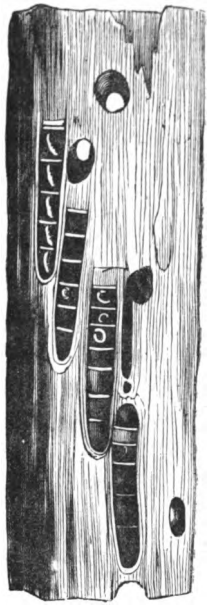
parallel to the grain of the wood—that is, in the same direction that the grain runs—for some six or seven inches. In carrying out this work, she wastes none of the chips and fragments, but lays them aside in some secure place, sheltered from the wind.



GALLERIES FORMED BY THE CARPENTER-BEE.

"The tunnel is now complete. Upon what does our Xylocopa next employ herself? She is fatigued, and wants rest; but she seeks that rest, as all wise men should seek it, in change of employment. She goes in search of flower-farina and honey. With these she accumulates a tiny heap at the bottom of her nest, and upon the top deposits an egg.

"So far, so good. But the little insect knows her work is not done, and proceeds to build over the egg a vault or ceiling, which is intended to form the floor of another cell. For this purpose she resorts to her supply of chips, and fixes them in a ring above the heap of pollen, cementing

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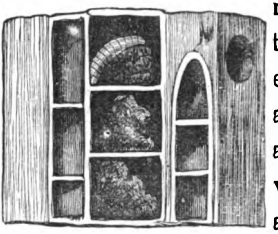
them together with a glutinous substance, supposed to be secreted by herself. Inside this ring she places another, and inside the second a third; and so she proceeds, until she has built up a nearly flat ceiling of consecutive rings—the thickness of the whole being equal to about the thickness of a penny. The number of cells constructed by the same insect is very variable; but the average seems to be seven or eight in each tunnel, and certainly the bee excavates more than one tunnel. As the tunnel, taken as a whole, exceeds a foot in length, and is wide enough to admit the passage of its wide-bodied builder, the amount of labour performed is certainly wonderful. And what are the bee's instruments?"

FLOOR OF THE CELL.



NESTS OF THE CARPENTER-BEE.

"Her feet and her jaws, I suppose."

"No, her jaws alone! with these she drives twelve inches deep into the solid wood.

"But there are several other carpenter or wood-boring bees, of which I should like to speak

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to you. One of them, the Willow-Bee (*Megachile Willoughbiella*), or Rosecutter-Bee, as it is sometimes called, is very frequently met with in our country. Her building operations are characteristic. She begins by boring a hole of proper size in some old tree—generally a willow; and when she has completed it, she goes off to a rose-bush, or a 'gold-dropping laburnum,' and here selects a particular leaf, out of which her sharp jaws quickly cut a semi-circular piece. As she supports herself, meanwhile, on the very piece of leaf she is cutting, she would fall to the ground along with it, did she not take the precaution of balancing herself on her wings for a few moments before the last cut is made.

TOOLS OF THE CARPENTER-BEE.

"With her prize firmly held between her jaws, she flies away to her nest, and binding the leaf into a kind of curve, presses it into the interior. Off she goes for another leaf, and, returning, thrusts it inside the former. This process she repeats until she has formed a small thimble-shaped cell, at the bottom of which she deposits an egg and some bee-bread. Then she constructs a second cell; and then a third; and so the work goes on, until she has formed a series of cells,

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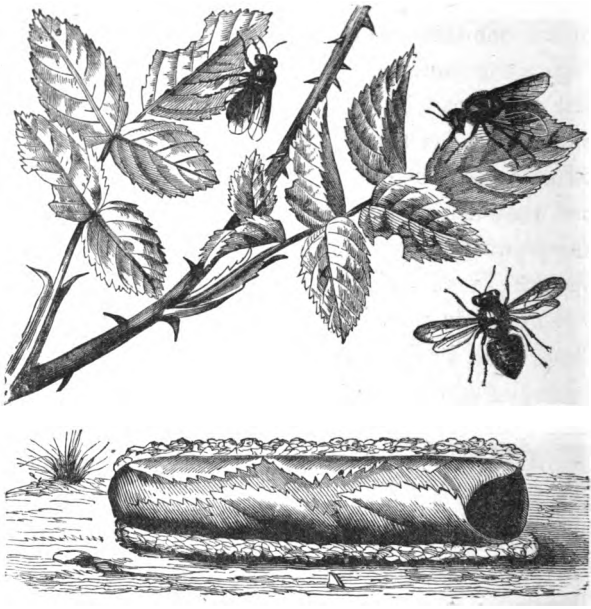
each about two inches deep. It is said that when the cells are originally made, the natural elasticity of the leaf renders them firm; and that, in a few



MEGACHILE WILLOUGHBIELLA (LEAF-CUTTING BEES).

days, they grow so solid and stiff, that they can be removed from the nest, and freely handled without breaking."

"Bravo, old Xylocopa!" exclaimed Charlie.

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"Perhaps the work of a pith-boring bee, called *Hylæus dilatatus*, is more curious than anything I have yet described. This ingenious creature will make use of a hollow stem or stalk, like that of the hemlock, if she can get hold of a suitable one; otherwise, she scorns delights, and lives laborious days in excavating a burrow of the size she needs. Other bees of this order may be found inside the dry twigs of the garden rose, and bramble, and plants of a similar character—even in the reeds and rushes which flourish on the margin of stream, pond, or river. 'If,' says a good authority, 'if at the cut end of a branch a round hole be found in the pith, the observer may be sure that a nest of some kind is within. Generally, on carefully laying the branch open, there appears a whole series of cells, one above the other; and in such a case, the cells which are furthest from the aperture always contain the larvæ of the female insects, those nearest the entrance being the males.'

"Let me quote from the same authority a still more interesting passage:—

"He says that the nests found in the bramble not seldom contain the larvæ of the *Osmia leucomelana*."

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"Two crack-jaw words, papa!" exclaimed Charlie; "*Osmia leu-co-me-la-na!*"

"Well, if the name be hard of sound and long to spell, the insect designated by it is both pretty and little. It is scarcely more than a quarter of an inch in length, is black in colour, with a very glossy abdomen, and has a white, downy look about the legs. Five or six cells are made in each branch, and the perfect insect appears about the month of June.

"Other bees of this genus show much ingenuity in saving themselves labour. And yet they are not idle; they can work as well as any of their kind, when they feel that there is a necessity for them to do so. But, apparently, they have discovered the truth that needless labour is as great a folly as waste of time. The smaller species are very fond of making their cells inside straws, and a thatched roof often contains thousands of nests, which are unsuspected by man, and only discovered by the tomtits and other birds, whose sharp eyes soon detect the hidden insect, and whose ready bills pull the straw out of the thatch and pick the larvæ from their cells. Nail-holes in garden walls are often filled with cells; and so are the auger-holes in old rails

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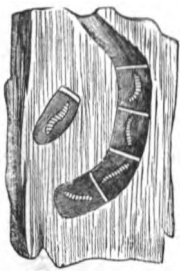
and posts, from which the wooden pins have fallen.

"As thatched roofs are rapidly disappearing, and our cottages and barns are being covered in with tiles or slates, I often wonder what will become of the numerous insects which have been accustomed to live and work in the overhanging eaves.

"Now, what I have had to say about the carpenter-bee, will fitly conclude with some judicious remarks by Mr. F. Smith :—

"'One of these bees may be observed to alight on an upright post, or other wood suitable for its purposes. She commences the formation of her tunnel, not by excavating *downwards*, as she would be incommoded with the dust and rubbish she removes; no, she works *upwards*, and so avoids such an inconvenience. When she has proceeded to the length required, she proceeds in a horizontal direction to the outside of the post, and then her operations are continued *downwards*. She excavates a cell near the bottom of the tube, a second and a third, and so on, to the required



PUPÆ OF THE CARPENTER-BEE IN THEIR NURSERIES.

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number. The larvæ, when full fed, have their heads turned upwards. The bees which arrive at their perfect condition, or rather those which are first anxious to escape into day, are two or three in the upper cells—these are males; the females are usually ten or twelve days later. This is the history of every wood-boring bee which I have bred, and,' says Mr. Smith, 'I have reared broods of nearly every species indigenous to this country.'"

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CHAPTER VII.

THE HUMBLE-BEE.

"BUT, papa, I don't think you have said, as yet, a word about the Humble-Bee, though a very jolly-looking fellow he is."

"Then let us turn our attention to him immediately. I suppose you know he is longer than the common bee, that his body is thicker and more hairy, that the hairs are often arranged in coloured bands, and that, unlike the common bee, the tibiæ of the hind-legs terminate in two spines. Humble-bees, moreover, do not gather in such large communities as the hive-bees; their nests seldom contain above three hundred, and frequently not more than fifty or sixty. Their females are not very prolific, and at

MALE HUMBLE-BEE.

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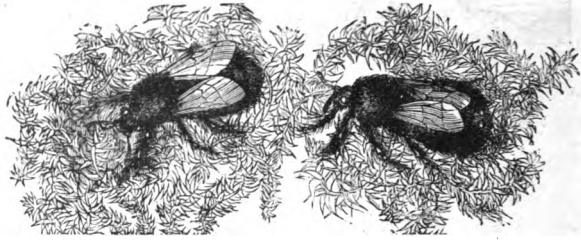
the approach of winter the whole community is dissolved; the males and workers die, and the females



NESTS OF THE MOSS HUMBLE-BEE.

sink into torpor, remaining in this condition until the return of spring recalls them to their duties

ANOTHER EXAMPLE OF THE HUMBLE-BEE'S NEST.

as founders of new communities. Their nests—I am speaking of our common English humble-bee,

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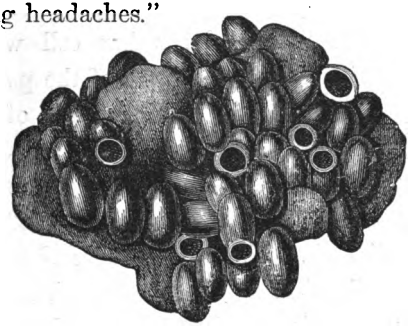
the *bumbee* or boom-bee of the Scotch—consist of holes in the earth, a foot deep or more, with an inner coating of wax, and a flooring of leaves. Other species build them of wax among soft moss; others conceal them among stones. As the family increases in number, the homestead increases in size.

"On examining a humble-bee's nest, you will find it closely resembling that of a wasp. Some of the cells contain larvæ; in others, which are closely covered, lie the larvæ or nymphs in different stages of growth; while others, again, are filled with a sweet-flavoured and sweet-scented honey. Of this honey let me advise you, Charlie, never to eat; for even if taken in very small quantities, it will afflict you with distracting and enduring headaches."



CELLS FROM A HUMBLE-BEE'S NEST.

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CHAPTER VIII.

OTHER KINDS OF BEES AND THEIR WAYS.

"O beautiful bee-homestead! with many a waxen cell
Self-built—for hanging, so it seems—that airy citadel!
An unbought blessing to man's life, which neither any hoe,
Nor axe, nor crooked sickle is needed to bestow;
A tiny vessel—and no more—wherein the busy bee
From its small body liquid sweets distilleth lavishly!
Rejoice, ye blessèd creatures! regaling while ye rove,
Wing'd workers of nectareous food! on all the flowers ye love!"

PROFESSOR WILSON.

VERY curious species of solitary 'leaf-cutting' bees has been called the Poppy-Bee (*Osmia papaveris*), because she adorns her cell with the rich scarlet hangings of the poppy.

"The cell itself consists of a hole burrowed in a bank or heap of earth; it is generally about three inches deep, gradually widening as it descends, until it assumes the form of a small Florence oil-flask. The bee renders the interior of this tunnel as smooth, polished, and uniform as possible, so that it may be fitted for the reception

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of the tapestry with which it is intended to be decorated.

"The insect-upholsterer, as she has been called, betakes herself, so soon as her cell is complete, to the nearest scarlet field-poppy, from which she successively cuts off small oval pieces, seizes them between her legs, and conveys them to the nest. Beginning at the bottom, she lays down three or four leaves, one upon another, and then decorates the sides of her cell with two. If the piece she has brought is too large to fit the place intended, she cuts off what is superfluous, and carries away the refuse. If you cut the fresh petal of a poppy with a pair of scissors, you will see how difficult it is to keep the piece so cut from wrinkling and shrivelling; but the bee is able to spread the pieces which she uses as smooth as glass.

"Having thus tapestried her little apartment with glowing scarlet, she fills it with the pollen of flowers mixed with honey, to the height of about half an inch. In this accumulation of provisions she lays an egg, and over the egg she pulls the edges of her poppy-curtain. The upper part is then carefully filled in with earth.

"Rennie says, and very rightly, that it will,

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perhaps, be impossible ever to ascertain, beyond a doubt, whether the poppy-bee is induced to select the dazzling petals of the poppy from their colour, or from any other quality they may possess—such, for instance, as warmth or softness. The great French philosopher, Réaumur, thinks that her choice is determined by the largeness and flexibility of the poppy-leaves. Yet I would presume to say, with Mr. Rennie, that it is quite possible her eye may be gratified by the appearance of her nest; that she may possess a feeling of the beautiful in colour, as most birds do, and may look well-pleased on the rich hangings of the chamber prepared for her offspring.

"'Why,' says Rennie, 'should not an insect be supposed to have a glimmering of the value of ornament? Considering how little we know of the way in which the inferior animals think and act, what right have we to say that all they do is for usefulness, and not for pleasure? If a dog howls at the sound of a bugle, is it not because it offends its organs of hearing?'"

"And," interrupted Charlie, "if spiders come forth from their dens at the sound of a flute, is it not because the sweet music pleases *their* organs of hearing?"

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"Just so, Charlie; and why, then, may not a bee feel gratified with the brilliant hues of her scarlet drapery, because they relieve and refresh her organs of sight? It seems to me that all these inferior creatures work with far more ingenuity and finish than are absolutely necessary for their comfort or protection; and this circumstance alone would seem sufficient to prove that they have something of taste to exhibit, which produces in them an emotion of enjoyment.

"The tapestry-bee, however, satisfies herself with ornamenting the interior only of the nest which she forms for her progeny. She does not commit the error of some human artists, and lavish her embellishments where they are neither needful nor becoming. She asks for elegance, but she also demands security; and she does not sacrifice the latter to the former. 'Here is not a mansion rich with columns and friezes without, but cold and unfurnished within, like the desolate palaces of Venice.' It may be more justly compared to an English mansion, whose exterior is generally simple and unpretending, while the interior is replete with every comfort and luxury. At all events, the prudent bee covers her tapestry quite round with the common earth; and then she

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leaves her eggs enclosed in their cell of flower-leaves, assured that no plunderer can be attracted by any trace of her wonderful toil.

"But now, Charlie, I have come to the end of my 'tether;' in fact, I have wandered away from the answer to my question, 'Who was the First Architect?' I have shown you the bee not only as an architect, but as a mason, a burrower, a carpenter, an upholsterer; plying her various trades with an instinct and an ingenuity so remarkable and so singular, that we are compelled to admit they sometimes verge closely upon reason. And, from first to last, I have endeavoured, my boy, to impress upon you one great fact: that this ingenuity, instinct, intelligence—call it what you will—is the result of no chance, or scientific development, or natural laws, but was originally implanted in the insect's mind by that God whom all things in earth and heaven declare!"

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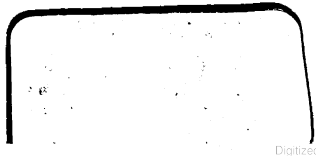
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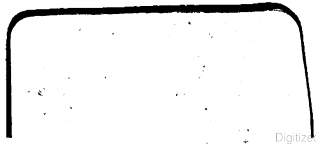
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